

REMARKS

The present amendment is prepared in accordance with the new requirements of 37 C.F.R. § 1.121. The clean copy of the claims is provided above. The marked-up copy of the claims is attached on separate sheets. In the marked-up version, inserted material is underlined and deleted material has a line therethrough.

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. Reconsideration is requested in view of the amendments above and the remarks below.

Applicants note that the restriction requirement has been made final and claims 5, 7-15, 17-23 and 25-34 have been withdrawn from further consideration as being drawn to a non-elected species, there being no allowable generic or linking claim. These claims have not been canceled because pursuant to the restriction requirement, the Examiner noted that upon the allowance of generic claims, Applicants will be entitled to consideration of the claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141.

Claims 1-4, 6, 16 and 24 are pending in the application for consideration by the Examiner.

Before we review the rejections in detail, it may be helpful to set forth Applicants' invention as now claimed. Applicants have amended independent claims 1, 16 and 24 to define the flexible strip of a thermal conductive material which is adhered to the surface of an integrated circuit device as being corrugated and also having a flat flexible strip of a

thermal conductive material bonded to one side thereto forming a single-faced flexible corrugated strip article. Basis for the amendment may be found in the claims and in the specification, for example, on page 3, the paragraph beginning at line 18. The Examiner's attention is also directed to the figures showing the various articles of the invention. Thus, in Fig. 1B, a corrugated tape article 19 is shown comprising a corrugated metal strip 16 bonded to a flat metal strip 17 which has an adhesive 18 thereon for applying and adhering the tape article 19 to the chip 15. This is an example of a single-faced tape article as now claimed in claims 1, 16 and 24. In Fig. 1C, a double-faced corrugated tape article 26 is shown adhered to chip 21 forming component assembly 20. The corrugated tape article 26 comprises a corrugated metal strip 22 with flat metal strips 23 and 24 bonded to opposed distal side of the corrugated metal tape 22. An adhesive 25 on metal strip 26 is used to adhere corrugated tape article 26 to chip 21.

It is respectfully submitted that prior art does not disclose nor teach Applicants' corrugate tape article as now claimed and that the claims are properly allowable under both 35 USC102(b) and 35 USC 103(a).

Claims 1-3, 6 and 16 have been rejected under 35 USC 102(b) as being clearly anticipated by Haushalter (Fig. 1), U.S. Patent No. 4,926,935.

Haushalter discloses a heat sink created from a single or multiple lengths of compressed, corrugated fin and eliminates the need for a heat sink base plate. A length of corrugated fin is compressed in a fixturing operation to form a continuous top flat surface and a continuous bottom flat surface. After the fixturing operation, a bonding operation is performed to generate permanent continuous top and bottom flat surfaces on which

elements requiring temperature control may be mounted directly, eliminating the cost and weight of a base plate. As can be seen from Figs. 1 and 2, the corrugated piece of fin of Fig. 1 is compressed to form the compressed article. There is clearly no flat flexible strip of thermal conductive material bonded to one side or to both sides of the corrugated strip as now claimed by Applicants and it is respectfully submitted that Applicants' invention is not disclosed nor taught by Haushalter.

Claims 1-3 and 6 are rejected under 35 USC 102(b) as being clearly anticipated by Smith (Fig.2), U.S. Patent No. 5,574,626.

The Examiner is citing Fig. 2 of Smith which shows an integrated circuit chip 10 having an existing heat sink 12 affixed thereto for dissipating heat from the integrated circuit chip 10. The existing heat sink 12 is of a type that comprises a laminated heat conductor material that is then corrugated such that the resulting folds form individual spaced fins 14 for dissipating heat from the integrated circuit chip 10. It is clear that there is no flat flexible strip of a thermal conductive material bonded to one side of the spaced fins 14 nor two flat flexible strips adhered to each side of the fins 14. Additionally, there is no disclosure in Smith to form such a single-faced or double-faced corrugated tape as now claimed by Applicants and it is respectfully submitted that the claims are properly allowable under 35 USC 102(b) and 35 USC 103(a) over Smith.

Claims 1-4, 6 and 16 are rejected under 35 USC 102(b) as being clearly anticipated by Takahashi U.S. Patent No. 5,528,456.

Takahashi shows a package with an improved semiconductor device heat transfer structure which uses a foil made of a heat conductive material having corrugations with

top portions in contact with the chip and bottom portions in contact with the radiator, transferring the heat from the semiconductor integrated circuit chip to the radiator. As exemplary as shown in Fig. 3, the corrugated foil 9 is in contact with cap 7 and chips 1 through solder connections 10. It is clear that Applicants single-faced or double-faced flexible corrugated strip article as now claimed are not shown nor disclosed by Takahashi and it is respectfully submitted that the claims are properly allowable under both 35 USC 102(b) and 35 USC 103(a).

Claim 24 is rejected under 35 USC 102(b) as being clearly anticipated by Smith-Johannsen U.S. Patent No. 2,711,382. The Examiner notes that the "article" claimed is the flexible strip, not the integrated circuit device that merely recites the "intended use" of the "article".


Smith-Johannsen shows a method of forming and applying metal heat exchange fins and shows in Fig. 1 a metal sheet 1 having an adhesive 2 on a surface and a backing tape 3 being used in Figs. 2-4 to form a corrugated fin article. The original backing material 3 is removed and a new backing tape 4 applied to the fin. In Figs. 5 and 6, when the fin is applied to an article to be cooled the backing tape 4 is removed. It is clear that Applicants' article of manufacture which is now defined as comprising a corrugated flexible strip of thermal conductive material having a flat flexible strip of thermal conductive material bonded to one side thereto forming a single-faced flexible corrugated strip article is not disclosed or taught in Smith-Johannsen. Similarly, Applicants' claimed double-faced flexible corrugated strip article is not disclosed nor taught therein. It is respectfully

submitted that claim 24 is properly allowable under both 35 USC 102(b) and 35 USC 103(a).

In summary, Applicants' invention as now claimed is directed to single-faced and double-faced corrugated flexible strips of thermal conductive materials which are used for dissipating heat in integrated circuit devices. Such single-faced or double-faced flexible corrugated strip articles are not shown nor taught by the references.

It is respectfully submitted that the application has now been brought into a condition where allowance of the case is proper. Reconsideration and issuance of a Notice of Allowance are respectfully solicited. Should the Examiner not find the claims to be allowable, Applicants' attorney respectfully requests that the Examiner call the undersigned to clarify any issue and/or to place the case in condition for allowance.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE**In the Claims**

Claims 2, 11, 19, 25, 26 and 31 have been canceled.

Claims 1, 3, 4, 12, 13, 16, 20, 21, 24, 27 and 28 have been amended as follows.

1. (Amended) A method to enhance integrated circuit device heat dissipation comprising the steps of:

providing an integrated circuit device having a surface;

providing a flexible corrugated strip of a thermal conductive material having a flat

flexible strip of a thermal conductive material bonded to one side thereto forming

a single-faced flexible corrugated strip article; and

adhering the strip article to the surface of the integrated circuit device.

3. (Amended) The method of claim ~~2~~ 1 wherein the strip is metal and is copper or aluminum.

4. (Amended) The method of claim 3 wherein the thickness of the strip ~~is used to~~ make the corrugated strip and the flat flexible strip are both about 0.5 mil to 10 mil.

12. (Amended) The method of claim ~~11~~ 1 wherein the flat flexible strip article has an adhesive thereon on the side to be adhered to ~~an~~ the integrated circuit device.

1 13. (Amended) The method of claim ~~4~~1 wherein the single-faced flexible corrugated
2 strip article has a flat flexible strip of thermal conductive material bonded to the other side
3 of the flexible corrugated strip forming a double-faced flexible corrugated strip.

1 16. (Amended) A method to enhance integrated circuit device heat dissipation
2 comprising the steps of:

3 providing an integrated circuit device having a surface;

4 providing a strip of flexible flat thermal conductive material;

5 forming corrugations in the flexible thermal conductive material; ~~and~~

6 bonding a thermal conductive material flat strip to one side of the flexible corrugated

7 strip forming a single-faced flexible corrugated strip article; and

8 adhering the single-faced flexible corrugated strip ~~flexible thermal conductive material~~

9 to the surface of ~~an~~the integrated circuit device.

1 20. (Amended) The method of claim ~~19~~16 wherein an adhesive is applied to the side
2 of ~~a~~the single-faced corrugated strip article to be adhered to ~~an~~the integrated circuit
3 device.

1 21. (Amended) The method of claim ~~19~~16 wherein a second flexible strip thermal
2 conductive material is bonded to the other side of the corrugated flexible thermal
3 conductive material forming a double-faced corrugated strip article.

1 24. (Amended) An article of manufacture for dissipating heat for integrated circuit
2 devices comprising a corrugated flexible strip of thermal conductive material having a flat
3 flexible strip of a thermal conductive material bonded to one side thereto forming a
4 single-faced flexible corrugated strip article ~~having an adhesive on a portion thereof~~
5 ~~which will contact with and adhere the strip to an integrated circuit device.~~

1 27. (Amended) The article of claim ~~26~~ 24 wherein the flat strip of thermal conductive
2 material has an adhesive on the side to be adhered to an Integrated circuit device.

1 28. (Amended) The article of claim ~~26~~ 24 wherein a second flat flexible strip of
2 thermal conductive material is bonded to the other side of the corrugated ~~tape~~ material to
3 form a double-faced flexible corrugated strip article.